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TECHNICAL MEMORANDUM

TO: Bill Dana - DEQ Project Officer

FROM: Chad Nancarrow - E & E CN

THRU: John Montgomery - E & E Project Manager

SUBJ: McCormick and Baxter - Proposed Treatment System Extraction Pump Enhancements

DATE: May 26, 1998

CC: David Anderson - DEQ; Steve Campbell - DEQ

INTRODUCTION

Ecology & Environment (E & E) has prepared this technical memorandum to present proposed extraction pump modifications in order to enhance NAPL recovery at the site. Based on discussions with DEQ and investigation of existing extraction operations, E & E proposes the following enhancements:

- Purchase two four-inch controllerless pneumatic pumps for installation at EW-4s and EW-7s (in TFA) for continuous DNAPL extraction.
- Relocate existing pneumatic pump in EW-1s (in TFA) to the well bottom for continuous DNAPL extraction.
- Purchase two two-inch pneumatic pumps with external controllers for installation at EW-6s and MW-Es (in FWDA) for continuous DNAPL extraction.
- Increase flow rate of existing pneumatic pump in EW-9s (in FWDA) for testing of up-welling effect.
- Install Spillbuster Magnum System 1.9 at EW-10s (in FWDA) for a continuous LNAPL extraction test period evaluation.

BACKGROUND

NAPL removal/recovery at the site is currently conducted via manual and automated extraction. Manual NAPL extraction is performed at several wells throughout the site which contain measurable quantities of DNAPL or LNAPL. A portable pump is utilized at each well to extract the NAPL. Manual extraction requires extensive labor to set up the extraction pump; operate the

pump to ensure minimal water extraction; clean the oil/water interface probe, pump, and hoses; and carry the product to the sludge tank.

Automated NAPL extraction is conducted at the TFA and the FWDA. In the TFA, total fluids extraction is conducted at wells EW-1s, EW-4s, and EW-7s. Extraction at EW-4s and EW-7s is currently conducted with dedicated electric centrifugal pumps at a flow rate of approximately 3.7 gallons per minute (gpm). A pneumatic Solo pump is currently used for extraction from EW-1s at a flow rate of approximately 2.3 gpm. These pumps are placed near the well bottom and extract both NAPL and water (total fluids), which are subsequently conveyed and treated in the Pilot Water Treatment System located in the Shop Building. Due to the operator intensive nature of this treatment system, the system is only operating during weekdays for approximately eight hours a day.

In the FWDA, automated extraction is performed at four wells: MW-Ds, MW-Gs, MW-20i, and EW-9s. NAPL and water from each extraction well is pumped to the FWDA treatment system, where the NAPL is separated via oil/water separation. Treatment system operaton and extraction in the FWDA is continuous (24 hours/day). Extraction is currently conducted with pneumatic pulse pumps manufactured by QED Environmental Systems (Model LP1401). Each pump is operated with an external controller which regulates the pump's pulse rate (flow rate). Except for the pump located in EW-9s, the pumps are installed at the bottom of each well and operated at low flow rates for the purpose of removing DNAPL with minimal water extraction.

The pump installed in EW-9s is positioned in the water column above the DNAPL/water interface to potentially induce the movement of more DNAPL toward the well. Thus far, this up-welling effort has been inconclusive.

LNAPL-only extraction is also conducted at the site via passive LNAPL skimmers, installed in wells EW-15s and MW-1s. This extraction process requires manual inspection and purging of the skimmers once every two weeks. To date, no continuous or automated LNAPL-only extraction is conducted, either in the TFA or FWDA.

PROPOSED EXTRACTION PUMP ENHANCEMENTS

EW-4s, EW-7s, and EW-1s (TFA)

Based on the successful operation of continuous NAPL-only extraction in the FWDA, E & E recommends conversion of the TFA extraction system from total fluids extraction to NAPL-only extraction. This will increase the NAPL-to-water extraction ratio. Extraction conversion will entail purchase of two four-inch controllerless pneumatic pumps for installation at EW-4s and EW-7s and flowrate modificatin of the existing pump at EW-1s.

EW-4s and EW-7s are currently equipped with four-inch electric centrifugal pumps. These pumps are not well suited for NAPL-only pumping, because they emulsify the NAPL, making NAPL quantification impossible and oil/water separation of the NAPL difficult. E & E recommends installation of controllerless pneumatic pumps in these wells. Pneumatic pumps rely on positive air displacement as the operative mechanism which facilitates product extraction without emulsification. Controllerless operation enables the pump to cycle automatically via an internal float that responds to the fluid level within the pump. This automation allows operation without the need for electrical equipment, cycle timers, downwell probes, or level controls at the wellhead. A cost analysis for four-inch controllerless pneumatic pumps is included in Attachment 1. Based on this analysis, E & E recommends the MVP-IV (TR-776), manufactured by

Durham Geo-Enterprises. A discharge line gate valve should also be installed which will provide control of the flow rate. The pumps will be set at low flow rates (approximately 0.1 gpm) for continuous NAPL-only extraction.

The remaining extraction well in the TFA, EW-1s, is equipped with a controllerless pneumatic Solo pump manufactured by QED. This pump is currently placed at the well bottom and is pumping total fluids (NAPL and water) at a flow rate of approximately 2.3 gpm. E & E recommends installation of a gate valve on the discharge line to reduce the flow rate to approximately 0.1 gpm. This adjustment will enable continuous extraction and will minimize unnecessary water extraction.

EW-6s and MW-Es (FWDA)

The FWDA treatment system currently maintains 24-hour continuous operation. Low flow DNAPL extraction is conducted at MW-Ds, MW-Gs, and MW-20i utilizing externally controlled pneumatic pulse pumps manufactured by QED Environmental Systems. Recent Remedial Actions Quarterly Reports submitted to DEQ indicate substantial DNAPL removal using this extraction process. E & E recommends the purchase and installation of two additional two-inch extraction pumps at EW-6s and MW-Es in order to increase NAPL recovery in the FWDA. These wells have historically contained substantial DNAPL and are prime candidates for NAPL extraction enhancement. A cost analysis for two-inch pneumatic pulse pumps with external controllers is included in Attachment 1. Based on this analysis, E & E recommends the Pulse Pump LP1301, manufactured by QED Environmental Systems. Each pump will be installed at the well bottom and field adjusted for low flow operation to minimize water extraction. (Note, two-inch *controllerless* pumps were not recommended by the pump manufacturers due to the increased potential for the control float to "hang-up" when pumping viscous liquids).

EW-9s (FWDA)

In the FWDA, EW-9s is currently dedicated to water-only pumping. This pumping is being conducted to test the potential for DNAPL up-welling resulting from groundwater extraction above the DNAPL interface. Extraction is conducted with an externally controlled pneumatic pulse pump manufactured by QED (model LP1401) and is currently pumping approximately one liter per minute (0.27 gpm). Recent monitoring has revealed no significant increase in DNAPL at EW-9s. One potential reason for the inconclusive results may be that the pumping rate is too low to create any significant NAPL migration influence. Previously, it was believed that higher water extraction rates could be attained by replacing the QED pneumatic pulse pump with a KVA 12-volt "sampling" pump. Recent conversation with both QED and KVA has proven this assumption untrue. Approximately 50 feet of head exists from the pump location (approximately four feet above the well bottom) to the top of the oil/water separator tank. Pump curves indicate that the maximum yield for a KVA pump at approximately 50 feet of head is approximately 2 liters per minute (0.5 gpm). Moreover, KVA specifications indicate that maximum continuous operation should not exceed 20 minutes. The existing QED pneumatic pulse pump, however, is designed to operate continuously and can yield approximately 1.25 gpm at 50 feet of head, as determined from the manufacturer's pump curve. Therefore, E & E recommends increasing the existing extraction rate to this maximum flow. If testing results indicate no up-welling effect and a greater flow is required, the purchase and installation of a higher yielding pump may be appropriate.

EW-10s (FWDA)

The final recommended extraction pump enhancement is installation of the Clean Earth Technology Spillbuster Magnum System 1.9 at EW-10s for continuous LNAPL extraction. The Spillbuster employs an interface sensor attached to a motorized reel (Auto Seeker) which

automatically raises and lowers the extraction probe to the product interface. E & E recommends rental of the unit for a four-month test period to determine if the system is worthy of purchase. The system will be installed in EW-10s which has historically contained significant quantities of LNAPL. A total cost estimate summarizing this pump system rental/purchase and all other recommended pump purchases specified above is included as Attachment 2.

ATTACHMENT 1

EXTRACTION PUMP COST ANALYSIS
McCORMICK & BAXTER CREOSOTING COMPANY
PORTLAND, OREGON

CONTROLLERLESS PNEUMATIC PULSE PUMPS

Application: Continuous DNAPL extraction from two 4-inch wells (EW-4s & EW-7s in TFA).

Cost Analysis:

Vendor	Pump Model	Unit Cost	Accessories	Unit Cost	Total Cost Per Well	Comments
QED Environmental Systems	Solo II SP4000	$1,895.00	Well Cap with Filter Regulator S4SF	$190.00	**$2,085.00**	Stainless steel construction. 5 gpm maximum. 2 year warranty.
			Throttle Valve (optional)	$45.00		
Clean Environment Equipment	AP4-BL	$1,800.00	Well Cap	$50.00	**$1,950.00**	Stainless steel construction. 14 gpm maximum. 5 year warranty.
			Filter/Pressure Regulator	$100.00		
Durham Geo-Enterprises	MVP-IV TR-776	$1,585.00	Well Cap with Air Exhaust Check Valve	$121.00	**$1,834.00**	Stainless steel construction. 11 gpm maximum. 5 year warranty.
			Filter/regulator assembly	$128.00		
			Gate Valve (optional)	$67.00		

= Pump recommended for purchase

ATTACHMENT 1

EXTRACTION PUMP COST ANALYSIS
McCORMICK & BAXTER CREOSOTING COMPANY
PORTLAND, OREGON

PNEUMATIC PULSE PUMPS WITH EXTERNAL CONTROLLERS

Application: Continuous DNAPL extraction from two 2-inch wells (EW-6s & MW-Es in FWDA).

Cost Analysis:

Vendor	Pump Model	Unit Cost	Accessories	Unit Cost	Total Cost Per Well	Comments
QED Environmental Systems	Pulse Pump LP1301 (Alpha pump)	$595.00	Pulse Sender Master Control L360	$1,420.00	**$2,220.00**	Stainless steel construction. 2.1 gpm maximum. 1 year warranty.
			Exhaust Valve	$125.00		
			Well Cap	$80.00		
Clean Environment Equipment	2" Canister (bottom loading)	$1,250.00	Timer Controller	$1,200.00	**$2,490.00**	Stainless steel construction. 3 gpm maximum. 1 year warranty.
			Well Cap	$40.00		
Durham Geo-Enterprises	Evacuator TR-401	$1,050.00	Controller TR-805	$945.00	**$2,275.00**	Stainless steel & teflon. 2.5 gpm maximum. 5 year warranty. Requires clean, dry air.
			Well Cap TR-742	$95.00		
			Filter Regulator TR-738	$185.00		
			Pulse Counter (optional)	$265.00		

= Pump recommended for purchase

ATTACHMENT 2

EXTRACTION PUMP ENHANCEMENT TOTAL COST ESTIMATE
McCORMICK & BAXTER CREOSOTING COMPANY

PORTLAND, OREGON

Pump Description	Application	Total Cost per Well*	Quantity	Total
Durham Geo-Enterprises MVP-IV TR-776 (4-inch controllerless pneumatic)	DNAPL extraction at EW-4s & EW-7s (TFA)	$1,834.00	2	$3,668.00
QED Pulse Pump LP1301 (2-inch pneumatic with external controller)	DNAPL extraction at EW-6s & MW-Es (FWDA)	$2,220.00	2	$4,440.00
Clean Earth Technology Magnum Spillbuster System 1.9	LNAPL continuous extraction at EW-10s	Monthly rental ** @ $900/mo. (Purchase)	4 months	$3,600.00 ($6,623.75)***
			TOTAL COST ESTIMATE	**$11,708.00**

* Includes required pump accessories. Optional accessories not included.

** Requires one month prepayment. 50% of the rental fee will be applied towards purchase (if purchase is warranted).

*** Quantity not included in Total Cost Estimate